REMARKS

Claims 1 and 4 have been amended. Claims 1-4 are pending in the present application. Applicant reserves the right to pursue original claims and other claims in other applications.

Applicant has amended claim 4 to delete the word "a" before the word "parallel", as suggested by the Examiner. Accordingly, the Examiner's objection to claim 4 is believed to be obviated.

Claims 1 and 4 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Boucot (U.S. Patent No. 5,632,787) ("Boucot") in view of Verrill et al. (U.S. Patent No. 5,938,800) ("Verrill").

The present invention is an autothermal reforming apparatus and process which employs "at least two catalytic reactors connected in parallel to the combustion chamber." As stated by the Examiner, Boucot does not disclose the use of at least two catalytic reactors connected in parallel to the combustion chamber. Therefore, Boucot does not alone present a prima facie case of obviousness under 35 U.S.C. § 103(a).

Given Boucot as the closest prior art, the skilled person confronted with the problems sought to be solved by the present invention, namely providing an autothermal reactor of increased capacity while avoiding the need for a large lining and while supplying the catalyst bed with a gas at much lower linear velocity than what is otherwise necessary to obtain a good mixing (see page 3 of the present application), would not find any suggestion in Verrill to arrive at the claimed invention.

Contrary to the present invention, Verrill is concerned with the provision of a heat exchange reactor with a compact and mobile design, and as a result, it teaches explicitly away from autothermal reforming (ATR) as it can be inferred from the text of

col. 2, lines 7-29 and col. 8, lines 23-28 of Verrill. As stated in the previous response to the first Office Action, the reactor disclosed by Verrill is a heat exchange reformer, wherein flue gas indirectly heats the catalyst bed, i.e., there is no physical interaction between the flue gas generated by a burner and the catalyst bed (see e.g., col. 6, lines 60-64). In the present invention, the flue gas (mixed combustion products) leaving the combustion chamber is in direct contact with the catalyst and is itself a reactant in the reforming process. Claims 1 and 4 have been amended in this regard to specifically recite that the combustion product leaving the combustion chamber "directly contacts and heats the catalyst beds" within the reactors.

Applicant traverses the interpretation of the Examiner that the heat exchange reactor of Verrill is divided in two reforming sections (420, 430) that are connected in parallel to the combustion chamber (burner 220). The explicit teaching of the figure in question, Fig. 4 (col. 7, lines 38-67 and col. 7, lines 1-11) is that the hot flue gases 250 generated by the burner 220 are passed through annulus 470 formed between the outer casing 410 and reformers 420, 430. In addition, reformers 420 and 430 are not identical. Reformer 420 is a tube filled with catalyst 490 so as to produce hydrogen containing reformate, while reformer 430 is a membrane-enhanced reformer used to separate hydrogen from said reformate. Heat transfer fins 510 are provided to improve heat conduction, which again occurs indirectly with the flue gas 250. Accordingly, Verrill teaches the operation of these reformers in series, so that the product from the first reformer serves as the feed to the second reformer. Clearly, this is in direct contrast with the very large autothermal reactor of the present invention, in which the catalytic reactors are operated in parallel with respect to the combustion chamber and with respect to the product gas from said reactors.

A heat exchange reactor employs completely different technology from autothermal reforming and is used in Verrill for a completely different purpose, namely

to provide a compact and mobile design. The skilled person would find no hint in Verrill that would prompt him to modify Boucot so as to arrive at the present invention, as defined by amended independent claims 1 and 4. The proposed combination of Boucot and Verrill to solve the problem to which the present invention is directed would be meaningless and would not result in the present invention.

Claims 2 and 3 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Boucot in view of Verrill as applied to claim 1, and further in view of Koyama et al. (U.S. Patent No. 4,935,037) ("Koyama").

Like Verrill, Koyama also discloses heat exchange reactor technology in which flue gas indirectly heats the catalyst bed, i.e., there is no physical interaction between the flue gas and the catalyst bed. Since Koyama, like Verrill, is concerned with the provision of a compact reactor design, the catalyst tube or catalytic reactor 4 containing catalyst 6 and the combustion chamber 15 are placed within the same reforming apparatus 1. In contrast, in the present invention, the combustion chamber is intentionally constructed separately from the catalytic reactors (page 2 of the present invention). Hence, Koyama is concerned with a complete different technical problem and a completely different reactor technology than the present invention. Accordingly, the rejection of claims 2 and 3 should be withdrawn.

For the reasons above as well as others, applicant respectfully submits that claims 1-4 are distinguishable over the prior art and should be allowed.

A prompt passage to issuance is earnestly solicited.

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Respectfully submitted,

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